

Functions

MCQ Test, Set 09

Time: 30 minutes

Maximum marks: 25

Name: _____ Class: _____ Date: _____

1. There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
2. Each correct answer carries 1 mark. There is no negative marking.
3. The key sheet and worked solutions are at the end of this test.

1. Let $A = \{-3, -2, -1, 0, 1, 2\}$ and $f(x) = x^2 + x$ for $x \in A$. The pre-images of 2 under f are
A. $\{6\}$ **B.** $\{-2, 1\}$ **C.** $\{1\}$ **D.** $\{-2\}$
2. If $A = \{-1, 0, 1\}$, $B = \{0, 1, 2\}$ and $f : A \rightarrow B$ is defined by $f(x) = x^2 + x$, then the range of f is
A. $\{0, 1, 2\}$ **B.** $\{1, 3\}$ **C.** $\{0, 2\}$ **D.** $\{-1, 0, 1\}$
3. The degree of the polynomial function $f(x) = 2x^6 - 3x^2 + x^7 - 5$ is
A. 6 **B.** 5 **C.** 4 **D.** 7
4. If f is a constant function on $\mathbb{R}$ with $f(0) = 4$, then $f(1) + f(2) + f(3) =$
A. 6 **B.** 4 **C.** 12 **D.** 24
5. The inclination of the line $y = 13 - 11x$ with the x-axis is
A. equal to 90° **B.** equal to 0°
C. less than 90° **D.** greater than 90°
6. For $2x^2 - 3x - 5 = 0$:
A. $\Delta = 49$, roots are real and distinct
B. $\Delta = -31$, roots are not real (imaginary)
C. $\Delta = 37$, roots are real and distinct
D. $\Delta = 49$, roots are real and equal
7. If α, β are the roots of $x^2 + 6x - 3 = 0$, then $|\alpha - \beta| =$
A. $2\sqrt{6}$ **B.** $4\sqrt{3}$ **C.** $2\sqrt{3}$ **D.** 6
8. The vertex of $y = -x^2 - 6x + 2$ is
A. $(-3, 11)$ **B.** $(3, 2)$ **C.** $(3, 11)$ **D.** $(-3, -11)$
9. The lowest point of the graph of $y = (x + 1)(x - 5)$ is
A. $(-2, -9)$ **B.** $(2, -9)$ **C.** $(2, 9)$ **D.** $(2, -5)$

10. If $(x + 2)^2 - 7 < 0$, then $x \in$
- A. $[-2 - \sqrt{7}, -2 + \sqrt{7}]$ B. $(-\infty, -2 - \sqrt{7}] \cup [-2 + \sqrt{7}, \infty)$
 C. $(-\infty, -2 - \sqrt{7}) \cup (-2 + \sqrt{7}, \infty)$ D. $(-2 - \sqrt{7}, -2 + \sqrt{7})$
-
11. If $-x^2 + x + 6 \geq 0$, then $x \in$
- A. $(-2, 3)$ B. $[-2, 3]$
 C. $(-\infty, -2] \cup [3, \infty)$ D. $(-\infty, -2) \cup (3, \infty)$
-
12. If $\log_x 125 = 3$, then $x =$
- A. 5 B. $\frac{125}{3}$ C. 375 D. 25
-
13. $\log_5 9 \cdot \log_3 25 =$
- A. 2 B. 1 C. 4 D. 225
-
14. The graph of $y = \log_{1/2} x$ passes through
- A. $(\frac{1}{4}, 2)$ B. $(2, 1)$
 C. $(4, 2)$ D. $(\frac{1}{2}, -1)$
-
15. $6^{\log_{36} 25} =$
- A. $\frac{1}{5}$ B. 6 C. 25 D. 5
-
16. $\frac{|-18|}{|-6|} =$
- A. 12 B. $\frac{1}{3}$ C. -3 D. 3
-
17. If $|5x - 2| < 8$, then $x \in$
- A. $[-\frac{6}{5}, 2]$ B. $(-\frac{6}{5}, 2)$
 C. $(-\infty, -\frac{6}{5}) \cup (2, \infty)$ D. $(-\infty, -\frac{6}{5}] \cup [2, \infty)$
-
18. If $|x^2 + 2x| = 3$, then $x \in$
- A. $\{-3, 1\}$ B. $\{-1, 3\}$ C. $\{1\}$ D. $\{-3, -1, 1, 3\}$
-
19. The critical points for solving $|2x + 7| + |4 - x| = 10$ are
- A. $\{-\frac{7}{2}, 4, 10\}$ B. $\{-4, \frac{7}{2}\}$ C. $\{-\frac{7}{2}, 4\}$ D. $\{\frac{7}{2}, 4\}$
-
20. If $|\frac{8x}{x^2 + 16}| \leq 1$, then $x \in$
- A. $[-4, 4]$ B. $\mathbb{R}$ C. $\mathbb{R} - \{0\}$ D. ϕ
-
21. The range of $f(x) = \sqrt{x}$ is
- A. $[1, \infty)$ B. $(0, \infty)$ C. $\mathbb{R}$ D. $[0, \infty)$
-
22. $[-8.6] + [-0.6] =$
- A. -9 B. -10 C. -8 D. -9.2
-
23. The domain of $f(x) = \frac{1}{\sqrt{[x]-x}}$ is
- A. ϕ B. $\mathbb{R}$ C. $\mathbb{Z}$ D. $\mathbb{R} - \mathbb{Z}$
-

24. If $x - [x] = 0$, then x is

- A.** a negative number
- C.** an integer

- B.** a positive number
 - D.** between 0 and 1
-

25. The graph of $y = 5^x$ cuts the y-axis at

A. (0, 5)

B. (1, 0)

C. (0, 1)

D. (5, 0)

Key sheet

1. B	2. C	3. D	4. C	5. D
6. A	7. B	8. A	9. B	10. D
11. B	12. A	13. C	14. A	15. D
16. D	17. B	18. A	19. C	20. B
21. D	22. B	23. A	24. C	25. C

Solutions

1. Let $A = \{-3, -2, -1, 0, 1, 2\}$ and $f(x) = x^2 + x$ for $x \in A$. The pre-images of 2 under f are

Pre-images of 2 are the elements of A whose image is 2

$$f(-2) = 2, f(1) = 2$$

Ans: (B) $\{-2, 1\}$

2. If $A = \{-1, 0, 1\}$, $B = \{0, 1, 2\}$ and $f : A \rightarrow B$ is defined by $f(x) = x^2 + x$, then the range of f is

$$f(-1) = (-1)^2 + (-1) = 0, f(0) = (0)^2 + (0) = 0, f(1) = (1)^2 + (1) = 2$$

Range = $f(A) = \{0, 2\}$ (not the codomain B)

Ans: (C) $\{0, 2\}$

3. The degree of the polynomial function $f(x) = 2x^6 - 3x^2 + x^7 - 5$ is

Degree = highest power of x with non-zero coefficient = 7

Ans: (D) 7

4. If f is a constant function on $\mathbb{R}$ with $f(0) = 4$, then $f(1) + f(2) + f(3) =$

$$f(x) = 4 \text{ for every } x$$

$$f(1) + f(2) + f(3) = 4 + 4 + 4 = 12$$

Ans: (C) 12

5. The inclination of the line $y = 13 - 11x$ with the x-axis is

$$\text{Here } a = -11 < 0$$

So the inclination is greater than 90°

Ans: (D) greater than 90°

6. For $2x^2 - 3x - 5 = 0$:

$$\Delta = b^2 - 4ac = (-3)^2 - 4(2)(-5) = 49$$

So the roots are real and distinct

Ans: (A) $\Delta = 49$, roots are real and distinct

7. If α, β are the roots of $x^2 + 6x - 3 = 0$, then $|\alpha - \beta| =$

$$\Delta = b^2 - 4ac = 6^2 - 4(1)(-3) = 48$$

$$|\alpha - \beta| = \frac{\sqrt{\Delta}}{|a|} = 4\sqrt{3}$$

Ans: (B) $4\sqrt{3}$

8. The vertex of $y = -x^2 - 6x + 2$ is

$$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac-b^2}{4a}\right) = \left(-3, \frac{-8-36}{-4}\right) = (-3, 11)$$

Ans: (A) $(-3, 11)$

9. The lowest point of the graph of $y = (x + 1)(x - 5)$ is

It cuts the x-axis at $x = -1, 5$; lowest point at $x = \frac{\alpha + \beta}{2} = 2$

$$y = (2 + 1)(2 - 5) = -9$$

Ans: (B) $(2, -9)$

10. If $(x + 2)^2 - 7 < 0$, then $x \in$

$$y = (x + 2)^2 - 7 = x^2 + 4x - 3$$

$a = 1 > 0$ (upward parabola)

$$\Delta = b^2 - 4ac = 4^2 - 4(1)(-3) = 28$$

$$y = 0 \Rightarrow x = \frac{-4 \pm \sqrt{28}}{2} = -2 \pm \sqrt{7}$$

Sign: + outside $-2 - \sqrt{7}$ and $-2 + \sqrt{7}$, - between them

$$\therefore x \in (-2 - \sqrt{7}, -2 + \sqrt{7})$$

Ans: (D) $(-2 - \sqrt{7}, -2 + \sqrt{7})$

11. If $-x^2 + x + 6 \geq 0$, then $x \in$

$a = -1 < 0$ (downward parabola)

$$\Delta = b^2 - 4ac = 1^2 - 4(-1)(6) = 25$$

$$y = 0 \Rightarrow x = \frac{-1 \pm 5}{-2} = -2, 3$$

Sign: - outside -2 and 3 , + between them

$$\therefore x \in [-2, 3]$$

Ans: (B) $[-2, 3]$

12. If $\log_x 125 = 3$, then $x =$

$$x^3 = 125 = 5^3 \Rightarrow x = 5$$

Ans: (A) 5

13. $\log_5 9 \cdot \log_3 25 =$

$$\log_5 9 = 2 \log_5 3, \log_3 25 = 2 \log_3 5$$

$$4 \log_5 3 \cdot \log_3 5 = 4 \times 1 = 4$$

Ans: (C) 4

14. The graph of $y = \log_{1/2} x$ passes through

$$\log_{1/2} \frac{1}{4} = \log_{2^{-1}} 2^{-2} = 2$$

So $(\frac{1}{4}, 2)$ is on the graph (each option checked as $y = \log_{1/2} x$)

Ans: (A) $(\frac{1}{4}, 2)$

15. $6^{\log_{36} 25} =$

$$6^{\log_{6^2} 5^2} = 6^{\log_6 5} = 5$$

Ans: (D) 5

16. $\frac{|-18|}{|-6|} =$

$$\frac{18}{6} = 3$$

Ans: (D) 3

17. If $|5x - 2| < 8$, then $x \in$

$$-8 < 5x - 2 < 8$$

$$\Rightarrow -8 + 2 < 5x < 8 + 2$$

$$\Rightarrow -\frac{6}{5} < x < 2$$

$$\Rightarrow x \in \left(-\frac{6}{5}, 2\right)$$

Ans: (B) $\left(-\frac{6}{5}, 2\right)$

18. If $|x^2 + 2x| = 3$, then $x \in$

$$x^2 + 2x = \pm 3$$

$$x^2 + 2x = 3 \Rightarrow x^2 + 2x - 3 = 0 \Rightarrow x = \frac{-2 \pm 4}{2} = -3, 1$$

$$x^2 + 2x = -3 \Rightarrow x^2 + 2x + 3 = 0, \Delta = -8 < 0: \text{no real } x$$

Ans: (A) $\{-3, 1\}$

19. The critical points for solving $|2x + 7| + |4 - x| = 10$ are

Critical points: where each expression inside $| |$ is 0

$$2x + 7 = 0 \Rightarrow x = -\frac{7}{2}; 4 - x = 0 \Rightarrow x = 4$$

Ans: (C) $\{-\frac{7}{2}, 4\}$

20. If $\left|\frac{8x}{x^2+16}\right| \leq 1$, then $x \in$

$$\frac{8|x|}{x^2+16} \leq 1 \text{ (the denominator is positive)}$$

$$(i) x < 0: -8x \leq x^2 + 16 \Rightarrow x^2 + 8x + 16 \geq 0 \Rightarrow (x + 4)^2 \geq 0: \text{true for all } x < 0$$

$$(ii) x \geq 0: 8x \leq x^2 + 16 \Rightarrow x^2 - 8x + 16 \geq 0 \Rightarrow (x - 4)^2 \geq 0: \text{true for all } x \geq 0$$

$$\text{From (i), (ii): } x \in (-\infty, 0) \cup [0, \infty) = \mathbb{R}$$

Ans: (B) $\mathbb{R}$

21. The range of $f(x) = \sqrt{x}$ is

$\sqrt{x}$ is defined for $x \geq 0$ and $\sqrt{x} \geq 0$

$$\text{Range} = [0, \infty)$$

Ans: (D) $[0, \infty)$

22. $[-8.6] + [-0.6] =$

$$-9 \leq -8.6 < -8, \text{ so } [-8.6] = -9; [-0.6] = -1$$

$$-9 + (-1) = -10$$

Ans: (B) -10

23. The domain of $f(x) = \frac{1}{\sqrt{[x]-x}}$ is

Need $[x] - x > 0$, i.e. $[x] > x$

$[x] > x$ for no real x : domain = ϕ

Ans: (A) ϕ

24. If $x - [x] = 0$, then x is

$$x - [x] = 0 \Rightarrow [x] = x, \text{ which holds exactly for } x \in \mathbb{Z}$$

Ans: (C) an integer

- 25.** The graph of $y = 5^x$ cuts the y-axis at
put $x = 0$: $y = 5^0 = 1$
Ans: (C) (0, 1)
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